(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
1 February 2001 (01.02.2001)

PCT

(10) International Publication Number
WO 01/08426 A2

(51) International Patent Classification[7]: H04Q 7/00

(21) International Application Number: PCT/SE00/01399

(22) International Filing Date: 30 June 2000 (30.06.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/145,221 23 July 1999 (23.07.1999) US
09/468,643 22 December 1999 (22.12.1999) US

(71) Applicant: TELEFONAKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; SE-126 25 Stockholm (SE).

(72) Inventors: YARED, Marlene; 53 Roosevelt, Dollard des Ormeauway, Québec H9G 1J1 (CA). MAZUR, Sara; Vikavägen 11, S-167 71 Bromma (SE). MOLNÖ, Johan; Kungsklippan 12, S-112 75 Stockholm (SE).

(74) Agents: NORIN, Klas et al.; Ericsson Radio Systems AB, Common Patent Department, S-164 80 Stockholm (SE).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *Without international search report and to be republished upon receipt of that report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

AR

(54) Title: MULTIPLEXING OF REAL TIME USERS AND NON-PRIORITY USERS ON AN EGPRS CHANNEL

(57) Abstract: Real time services (e.g., speech communication) are multiplexed with non-priority services (e.g., short message service and/or electronic mail service) once a silent period is detected in a real time communication. The non-priority services are aborted once the real time communication has become active again after the silent period.

WO 01/08426 A2

MULTIPLEXING OF REAL TIME USERS AND NON-PRIORITY USERS ON AN EGPRS CHANNEL

BACKGROUND

The present invention relates generally to radiocommunication systems and, more particularly, to techniques and structures for the efficient use of silent periods in speech communication.

The growth of commercial communication systems and, in particular, the explosive growth of cellular radiotelephone systems worldwide, has compelled system designers to search for ways to increase system capacity and flexibility without reducing communication quality beyond consumer tolerance thresholds. Mobile calls for example, may be routed in a circuit switched fashion, a packet switched fashion, or some hybrid thereof. It has become increasingly desirable to couple and to integrate mobile cellular telephone networks, for instance a GSM network, to Internet protocol (IP) networks for call routing purposes. The routing of voice calls over IP networks is frequently termed "voice over IP" or, more succinctly, VoIP.

Packet-switched technology, which may be connection-oriented (e.g., X.25) or "connectionless" as in IP, does not require the set-up and tear-down of a physical connection, which is in marked contrast to circuit-switched technology. This reduces the data latency and increases the efficiency of a channel in handling relatively short, bursty, or interactive transactions. A connectionless packet-switched network distributes the routing functions to multiple routing sites, thereby avoiding possible traffic bottlenecks that could occur when using a central switching hub. Data is "packetized" with the appropriate end-system addressing and then transmitted in independent units along the data path. Intermediate systems, sometimes called "routers," stationed between the communicating end-systems make decisions about the most appropriate route to take on a per packet basis. Routing decisions are based on a number of characteristics, including: least-cost route or cost metric; capacity of the link; number of packets waiting for transmission; security requirements for the link; and intermediate system (node) operational status.

FIG. 1 shows representative architecture used for communicating across an air link that comprises the packet data protocols which provide connectivity between a mobile end system (e.g., a mobile station), a mobile data base station (MDBS), and a mobile data intermediate system (MD-IS). An exemplary description of the elements in FIG. 1 and an approach for each element when considering alternative RF technologies follows.

The Internet Protocol/Connectionless Network Protocol (IP/CLNP) are network protocols that are connectionless and widely supported throughout the traditional data network community. These protocols are independent of the physical layer and preferably are not modified as the RF technologies change.

The Security Management Protocol (SMP) provides security services across the air link interface. The services furnished include data link confidentiality, M-ES authentication, key management, access control, and algorithm upgradability/replacement. The SMP should remain unchanged when implementing alternative RF technologies.

The Radio Resource Management Protocol (RRMP) provides management and control over the mobile unit's use of the RF resources. The RRMP and its associated procedures are specific to the AMPS RF infrastructure and require change based on the RF technology implemented.

The Mobile Network Registration Protocol (MNRP) is used in tandem with a Mobile Network Location Protocol (MNLP) to allow proper registration and authentication of the mobile end system. The MNRP should be unchanged when using alternative RF technologies.

The Mobile Data Link Protocol (MDLP) provides efficient data transfer between the MD-IS and the M-ES. The MDLP supports efficient mobile system movement, mobile system power conservation, RF channel resources sharing, and efficient error recovery. The MDLP should be unchanged when using alternative RF technologies.

The Medium Access Control (MAC) protocol and associated procedures control the methodology M-ESs used to manage shared access to the RF channel. This protocol and its functionality is supplied by alternative RF technologies.

With the introduction of new services or applications over packet data systems, for example, real time (RT) services such as VoIP, there will be a large variety of Quality of Service (QoS) demands on the network. Certain users, for example, those utilizing real time voice applications will have a very high demand for the availability of transmission resources, whereas users, for example, who transmit short messages or electronic mail, will be satisfied with a lower availability of transmission resources.

For example, in the well known Universal Mobile Telecommunications System (UMTS), there are four proposed QoS classes: the conversational class; streaming class; interactive class; and background class. The main distinguishing factor between these classes is the sensitivity to delay of the traffic. Conversational class traffic is intended for traffic which is very delay sensitive while background class traffic is the most delay insensitive traffic class. Conversational and streaming classes are intended to be used to carry RT traffic flows and interactive and background classes are intended to be used to carry Internet applications (e.g., WWW, E-mail, Telnet, FTP, etc.).

Real time services include sensitive time constraints over a reserved access channel. That is, delays in the transmission and/or receipt of successive packets can have noticeable and undesirable QoS effects (e.g., on voice quality). These time constraints can be handled by always reserving access time at predetermined intervals during a communication with high QoS demands. In this way, a real time service communication can proceed uninterrupted since it will be allocated communication resources regardless of whether or not any packets will be sent. That is, for example, silent periods will occur in a real time voice communication, and in order to conserve battery resources, the silent periods need not be transmitted.

Silent periods can be detected in a Voice Activity Detector (VAD) device. During silent periods, a Silence Descriptor (SID) is sent to a receiver. The SID informs the receiver that a silent period has begun. In addition, the SID indicates the type of "comfort noise" which is to be generated at the receiver. The receiver

generates comfort noise in order to closely mimic the naturally occurring background noise so that the receiving user perceives that the communication path between the transmitter and the receiver is still open and operable. In addition to the SID, an indication is sent to the transmitter that there is no voice activity detected and the transmitter can reduce its transmitter output power or set it to zero for that connection. This technique is called Discontinuous Transmission (DTX). With DTX enabled, interference is decreased in the system, since transmitters will only emit output power when there is information to be transmitted (e.g., when voice activity is detected).

However, since resources are allocated for the real time services users regardless of whether or not packets are sent from the transmitter, it would be advantageous if these silent periods could be used in a more efficient way by allowing other applications to use the allocated resources during the silent periods without lowering the QoS of real time services.

SUMMARY

The present invention overcomes the above-identified deficiencies in the art by providing a method and system for multiplexing real time services (e.g., speech communication) and non-priority or less time-critical services (e.g., short message service and/or electronic mail service) once a silent period is detected in a real time communication. Furthermore, the present invention aborts these other services once the real time communication has become active again after the silent period.

According to a first aspect of the present invention, provided is a method of allocating communication resources. The method includes the steps of dedicating a communication resource for use by a real time application; monitoring usage of the resource by the real time application; and allocating the resource for use by a non-priority application when the resource is not being used by the real time application.

According to a further aspect of the present invention, provided is a system for allocating communication resources. The system includes a device that monitors an activity status of a first application and transmits a status signal, and a switch coupled to a transmitter and responsive to the status signal. The switch couples the first

application to the transmitter if the status signal indicates that the first application is active, and the switch couples the second application to the transmitter if the status signal indicates that the first application is not active.

According to a further aspect of the present invention, provided is a system for allocating communication resources. The system includes a first module dedicating a communication resource for use by a real time application; a second module monitoring usage of the resource by the real time application; and a third module allocating the resource for use by a non-priority application when the resource is not being used by the real time application.

BRIEF DESCRIPTION OF THE DRAWINGS

The above features of the present invention will be more apparent from the following description of the preferred embodiments with reference to the accompanying drawings, wherein:

FIG. 1 illustrates a protocol architecture for communicating across an air link;

FIG. 2 illustrates an exemplary embodiment of the present invention;

FIG. 3A is a flow chart illustrating an exemplary scheduling technique for the downlink of the present invention;

FIG. 3B is a flow chart illustrating an exemplary scheduling technique for the uplink of the present invention; and

FIG. 4 illustrates an allocation of blocks in an exemplary embodiment of the present invention.

DETAILED DESCRIPTION

In the following description, for purposes of explanation and not limitation, specific details are set forth, such as particular circuits, circuit components, techniques, etc. in order to provide a thorough understanding of the present invention. However, it will be apparent to one skilled in the art that the present invention may be practiced in other embodiments that depart from these specific details. In other instances, detailed

descriptions of well-known methods, devices, and circuits are omitted so as not to obscure the description of the present invention.

The exemplary radio communication systems discussed herein are described as using the time division multiple access (TDMA) protocol, in which communication between the base station and the mobile terminals is performed over a number of timeslots. However, those skilled in the art will appreciate that the concepts disclosed herein find use in other protocols, including, but not limited to, frequency division multiple access (FDMA), code division multiple access (CDMA), time division duplex (TDD), or some hybrid of any of the above protocols.

FIG. 2 illustrates an exemplary embodiment of the present invention. A communication system 200 includes a base station 202 and a plurality of communication devices 204, 206. Communication device 206 includes a transceiver 211, a speech codec 213, and a module 207 that performs VAD, SID, and DTX functions. Communication device 204 includes a transceiver 205 and a non-priority (NP) application 215 (e.g., short message service or electronic mail service). Thus, in this example, device 206 is an RT device and device 204 is an NP device.

The base station 202 includes a transceiver 214 which is connected to a multiplexing device 212. The multiplexing device 212 selectively connects a speech codec 208, or other real time (RT) application, and an NP application 210 to the transceiver 214. Though only one NP application is shown in FIG. 2, multiple NP applications can be provided and selectively connected to multiplexing device 212 for selective access to transmit or receive resources in the base station.

As shown, the speech codec 208 includes a module 209 that performs VAD, SID, and DTX functions. In the general case (i.e., either uplink or downlink), when the VAD detects the presence of speech, the multiplexing device 212 connects the speech codec to the transceiver 214. However, when the VAD detects a silent period, the multiplexing device 212 connects the NP application 210 to the transceiver 214.

Thus, the multiplexing device 212 allows NP applications to access the same transmission resource (e.g., blocks) used by the real time (RT) application(s). Since at least some resources are typically reserved for the RT application(s) when an RT

application is operating, the present invention increases overall system capacity by making it possible for an NP application to "steal" back the reserved RT resource during times when there is no speech activity.

The scheduling of different applications in the downlink is performed in the Radio Link Control (RLC) or MAC layer of the network. FIG. 3A is a flow chart illustrating an exemplary scheduling technique for the downlink (DL) of the present invention. During silent periods, since the silent speech blocks are not being transmitted to the RT device 206, comfort noise can be generated at the RT device 206 during the periods when the allocated transmission resource is being used by NP applications. In addition, during silent periods, further DL blocks containing a SID may be transmitted periodically (e.g., every 480 milliseconds (ms)) so that the parameters used to generate the comfort noise can be updated.

The VAD in the speech codec 208 examines each RT speech block produced by the RT application. If, in step 320, the VAD detects speech in the speech block, the DL block is scheduled for the RT application in step 322 and the multiplexing device 212 connects the speech codec 208 to the transceiver. If the VAD detects a silent speech block, a first DL block containing a SID is transmitted to the RT device 206. In step 323, the SID is used to create (or update) the parameters used to generate comfort noise. In step 324, the next DL block is scheduled for the NP application and the multiplexing device 212 connects the NP application 210 to the transceiver 214.

While a communication device is transmitting RT uplink (UL) blocks to base station 202 that contain speech, the communication system schedules the RT device 206 to transmit its UL blocks continuously. When the RT device 206 detects a silent period for the next UL block, the RT device 206 sends a first UL block containing a SID which informs the communication system that the RT device 206 is entering a silent period. During silent periods, further UL blocks containing a SID may be transmitted periodically (e.g., every 480 milliseconds (ms)) so that the parameters used to generate the comfort noise can be updated. During the silent periods, an NP application(s) can be allocated UL resources (e.g., NP device 204) however, the RT application from the RT device 206 will still be allocated a resource periodically so that the communication

system can determine when the RT application wishes to resume sending UL blocks. By permitting the NP application of NP device 204 to use the UL resource assigned to RT application of RT device 206, during periods of inactivity, the RT application may experience a loss of data or delay in reacquiring its UL resource after the period of inactivity ends. In order to balance the effect of the delay on QoS, the frequency of UL block allocation to the NP application(s) should be set to a value that provides the desired tradeoff (loss and/or delay) of UL blocks for the RT application and additional throughput for the NP application(s).

An example of the above technique will now be described with reference to FIG. 3B. On the UL, the communication system receives an UL block from a RT device 206. At step 332, the communication system determines if the UL block from the communication device 206 includes a SID. If speech is detected instead of a SID, then the next UL block is scheduled for the RT user in step 336. If, however, a SID is detected, then in step 334 in this example, the next three UL blocks are scheduled as follows: (1) the first UL block is scheduled for the NP application; (2) the second UL block is scheduled for the RT application; and (3) the third UL block is scheduled for the NP application. By interleaving the scheduling of the NP and RT UL blocks, the RT application can be quickly resumed if it has speech blocks to transmit. One skilled in the art will recognize that the specific interleaving pattern can be varied based on the desired effect on the QoS of the system. For example, at a periodicity of N blocks, one block is scheduled for RT and $N - 1$ blocks are scheduled for NP. If the spacing of the scheduled UL RT blocks is kept small (e.g., within two blocks or 20 ms), then the RT application should not suffer a noticeable loss of speech. However, other RT applications may have a higher tolerance to the loss of blocks prior to resuming communications, which allows for greater spacing between the scheduled UL RT blocks (e.g., three blocks or more).

In step 338, during the scheduled UL RT block, the communication system checks to see if an UL RT block has been sent. If an UL RT block has been sent, the communication system checks to see if the block contains speech or a SID. If it contains speech, then the next unscheduled UL block is scheduled for the RT

application in step 336. If, in step 340, the UL RT block contains a SID, the comfort noise parameters are updated at the communication system and the next three UL blocks are scheduled according to step 334. If no UL RT block was sent to the communication system, the next three UL blocks are also scheduled according to step 334.

FIG. 4 illustrates an allocation of blocks in the exemplary embodiment of the present invention as described above with respect to FIG. 3B. The DL frame from the communication system, the UL frame from a communication device using an RT application, and the UL frame from a communication device using an NP application are shown. Each block in the DL frame includes a Uplink State Flag field (USF) 352, 360 and a Temporary Flow Identifier field (TFI) 354. The USF field informs the communication devices of the allocation for the next UL block. For example, if a DL block 350 includes a USF which has the value RT (see USF 352), then the communication device running the RT application is alerted that it has been scheduled to transmit an RT block 362 on the next available UL opportunity. If, however, the USF has a value of NP (see DL block 358, USF 360), then the communication device using the NP application is alerted that is has been scheduled to transmit an NP block 374 on the next available UL opportunity. The TFI 354 is used to indicate an intended recipient of the payload 356 (e.g., speech data) of the DL block 350, 358. The UL blocks also include a TFI field which indicate the identity of the sender (e.g., TFI 364 for RT applications and TFI 376 for NP applications).

UL RT block 370 includes a SID 368 message indicating the beginning of a silent period. Blocks 372 and 380 represent unused blocks by the RT communication device during a scheduled time. The communication system is alerted to the resumption of RT communication by the RT communication device by receiving block 382 in its scheduled timeslot. Normal RT communication is then resumed after the last scheduled UL NP block 375 with UL RT block 384.

In an alternative embodiment of the present invention, if RT communication wishes to resume during a scheduled NP application, the un-sent blocks can be stored in the communication device and transmitted at the next scheduled opportunity. This

technique will introduce a delay proportional to the number of un-sent blocks stored in the communication device.

The foregoing has described the principles, preferred embodiments and modes of operation of the present invention. However, the invention should not be construed as being limited to the particular embodiments discussed above. While the above-described embodiments were provided using TDMA, one skilled in the art will appreciate that the present invention may be practiced in any of a number of different protocols such as CDMA, FDMA, TDD, etc. Thus, the above-described embodiments should be regarded as illustrative rather than restrictive, and it should be appreciated that variations may be made in those embodiments by workers skilled in the art without departing from the scope of the present invention as defined by the following claims.

WHAT IS CLAIMED IS:

1. A method of allocating communication resources comprising the steps of:
dedicating a communication resource for use by a real time application;
monitoring usage of said resource by said real time application; and
allocating said resource for use by a non-priority application when said resource is not being used by said real time application.

2. The method of claim 1, wherein said step of monitoring includes the step of evaluating a first block for the presence of a real time application and wherein said step of allocating includes indicating the presence of a silent period.

3. The method of claim 2, wherein said method further comprises the steps of:
transmitting a block for a non-priority application if said evaluating step does not detect the presence of said real time application; and
transmitting said first block if said evaluating step determines the presence of said real time application.

4. The method of claim 1, wherein said real time application is a speech application.

5. The method of claim 1, wherein said non-priority application is a short message service application.

6. The method of claim 1, wherein said non-priority application is an electronic mail application.

7. The method of claim 2, wherein said indicating the presence of a silent period includes the step of transmitting a silence descriptor.

8. The method of claim 1, wherein said step of monitoring further includes receiving an indication of an activity status of said real time application.

9. The method of claim 8, wherein said indication is transmitted from a codec and indicates the presence of a silent period.

10. The method of claim 8, wherein said indication includes a silence descriptor.

11. The method of claim 1, wherein said step of allocating allocates said resource for a predetermined number of blocks.

12. The method of claim 11, whereby said predetermined number of blocks is less than or equal to a number that represents a tolerable number of lost blocks for said real time application.

13. A system for allocating communication resources comprising:

a device that monitors an activity status of a first application and transmits a status signal; and

a switch coupled to a transmitter and responsive to said status signal,

wherein said switch couples said first application to said transmitter if said status signal indicates that said first application is active, and

wherein said switch couples said second application to said transmitter if said status signal indicates that said first application is not active.

14. The system of claim 13, wherein said device is a codec and wherein said status signal indicates the presence of a silent period.

15. The system of claim 13, wherein said status signal includes a silence descriptor.

16. The system of claim 13, wherein said first application is a real time application.

17. The system of claim 13, wherein said second application is a non-priority application.

18. The system of claim 16, wherein said first application is a speech application.

19. The system of claim 16, where said second application is a short message service application.

20. The system of claim 17, wherein said second application is an electronic mail application.

21. A system for allocating communication resources comprising:

a first module dedicating a communication resource for use by a real time application;

a second module monitoring usage of said resource by said real time application; and

a third module allocating said resource for use by a non-priority application when said resource is not being used by said real time application.

22. The system of claim 21, wherein said second module includes a fourth module evaluating a first block for the presence of a real time application and wherein said third module includes a module indicating the presence of a silent period.

23. The system of claim 22, further comprising:

a fifth module transmitting a block for a non-priority application if said fourth module does not detect the presence of said real time application; and

a sixth module transmitting said first block if said fourth module determines the presence of said real time application.

24. The system of claim 21, wherein said real time application is a speech application.

25. The system of claim 21, wherein said non-priority application is a short message service application.

26. The system of claim 21, wherein said non-priority application is an electronic mail application.

27. The system of claim 22, wherein said module indicating the presence of a silent period includes a module transmitting a silence descriptor.

28. The system of claim 21, wherein said second module further includes a module receiving an indication of an activity status of said real time application.

29. The system of claim 28, wherein said module receiving an indication receives said indication from a codec which indicates the presence of a silent period.

30. The system of claim 28, wherein said indication includes a silence descriptor.

31. The system of claim 21, wherein said third module allocates said resource for a predetermined number of blocks.

32. The system of claim 31, whereby said predetermined number of blocks is less than or equal to a number that represents a tolerable number of lost blocks for said real time application.

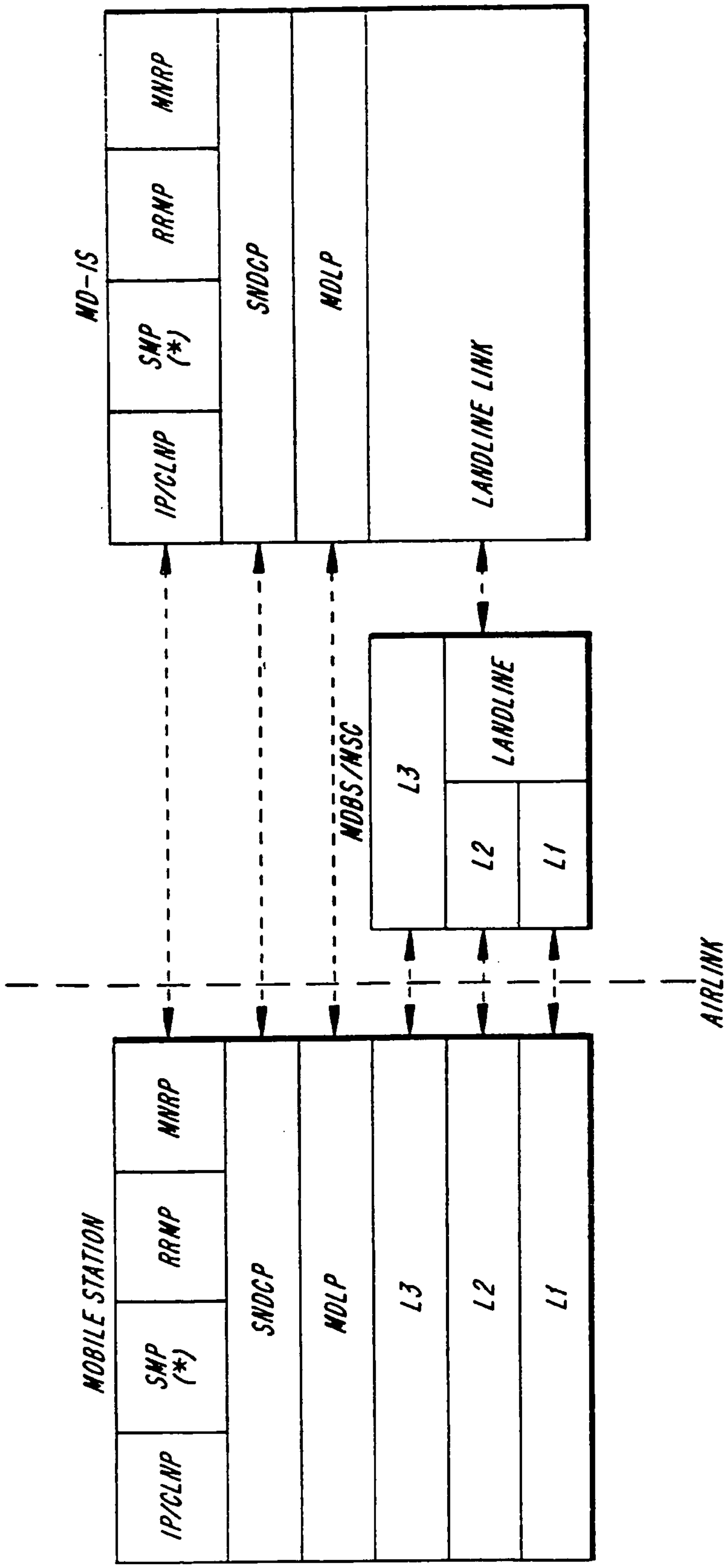

MD-IS
MNRP
RRMP
SMP (*)
IP/CLNP
SNDCP
MDLP
LANDLINE LINK
MDBS/MSC
L3
LANDLINE
L2
L1
AIRLINK
MOBILE STATION
MNRP
RRMP
SMP (*)
IP/CLNP
SNDCP
MDLP
L3
L2
L1

FIG. 1

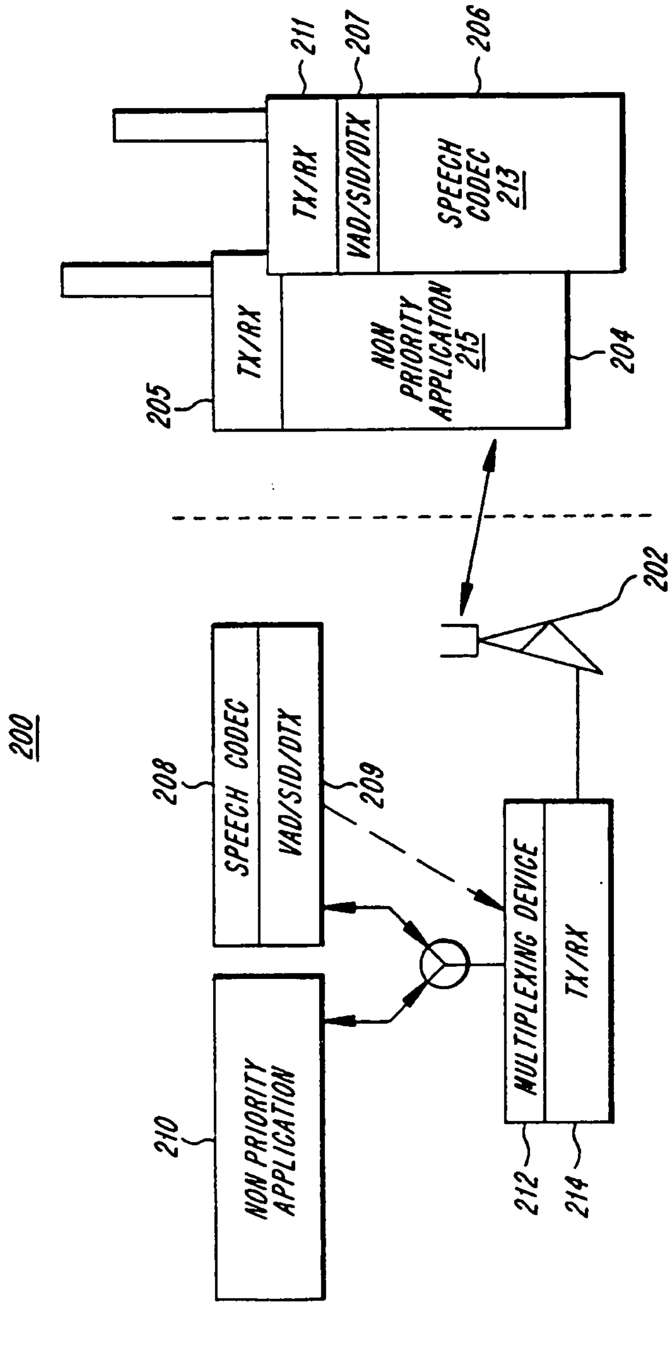

200
TX/RX
VAD/SID/DTX
SPEECH CODEC 213
211
207
206
TX/RX
NON PRIORITY APPLICATION 215
205
204
202
SPEECH CODEC
VAD/SID/DTX
208
209
NON PRIORITY APPLICATION
210
MULTIPLEXING DEVICE
TX/RX
212
214

FIG. 2

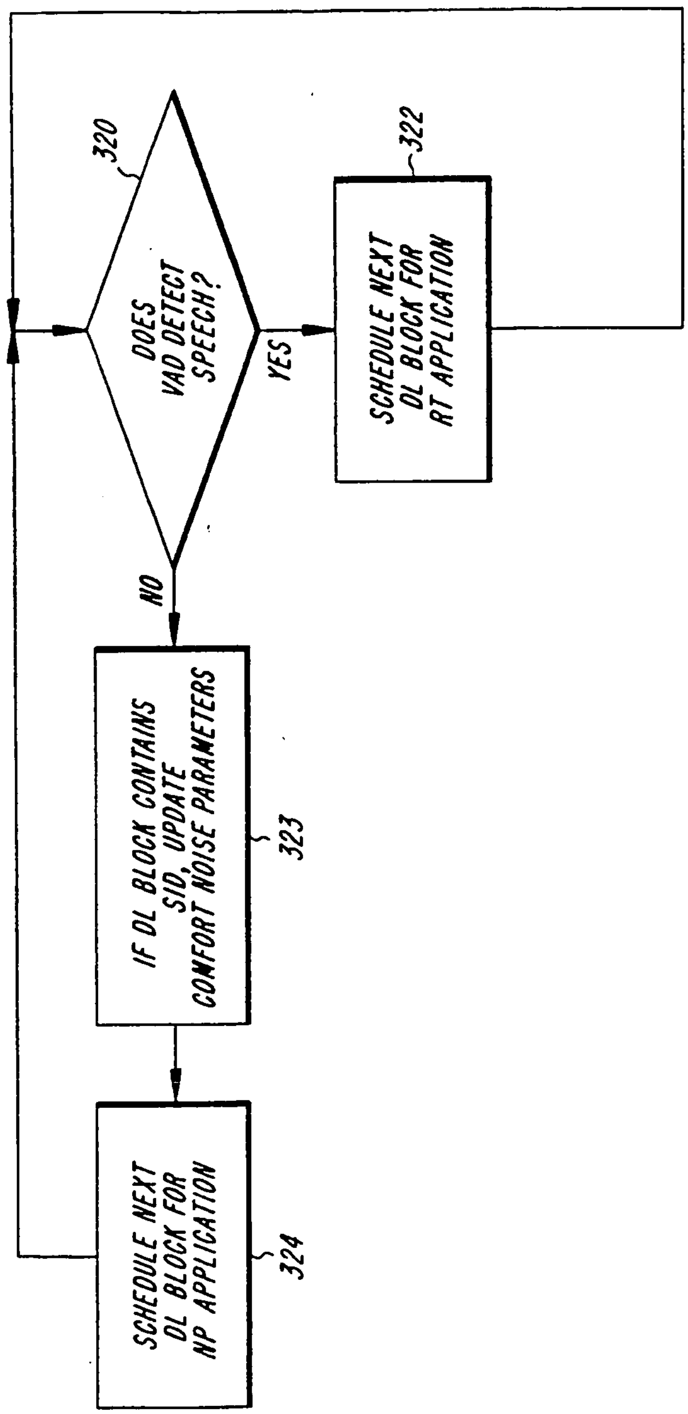

320
DOES
VAD DETECT
SPEECH?
YES
NO
322
SCHEDULE NEXT
DL BLOCK FOR
RT APPLICATION
IF DL BLOCK CONTAINS
SID, UPDATE
COMFORT NOISE PARAMETERS
323
SCHEDULE NEXT
DL BLOCK FOR
NP APPLICATION
324

FIG. 3A

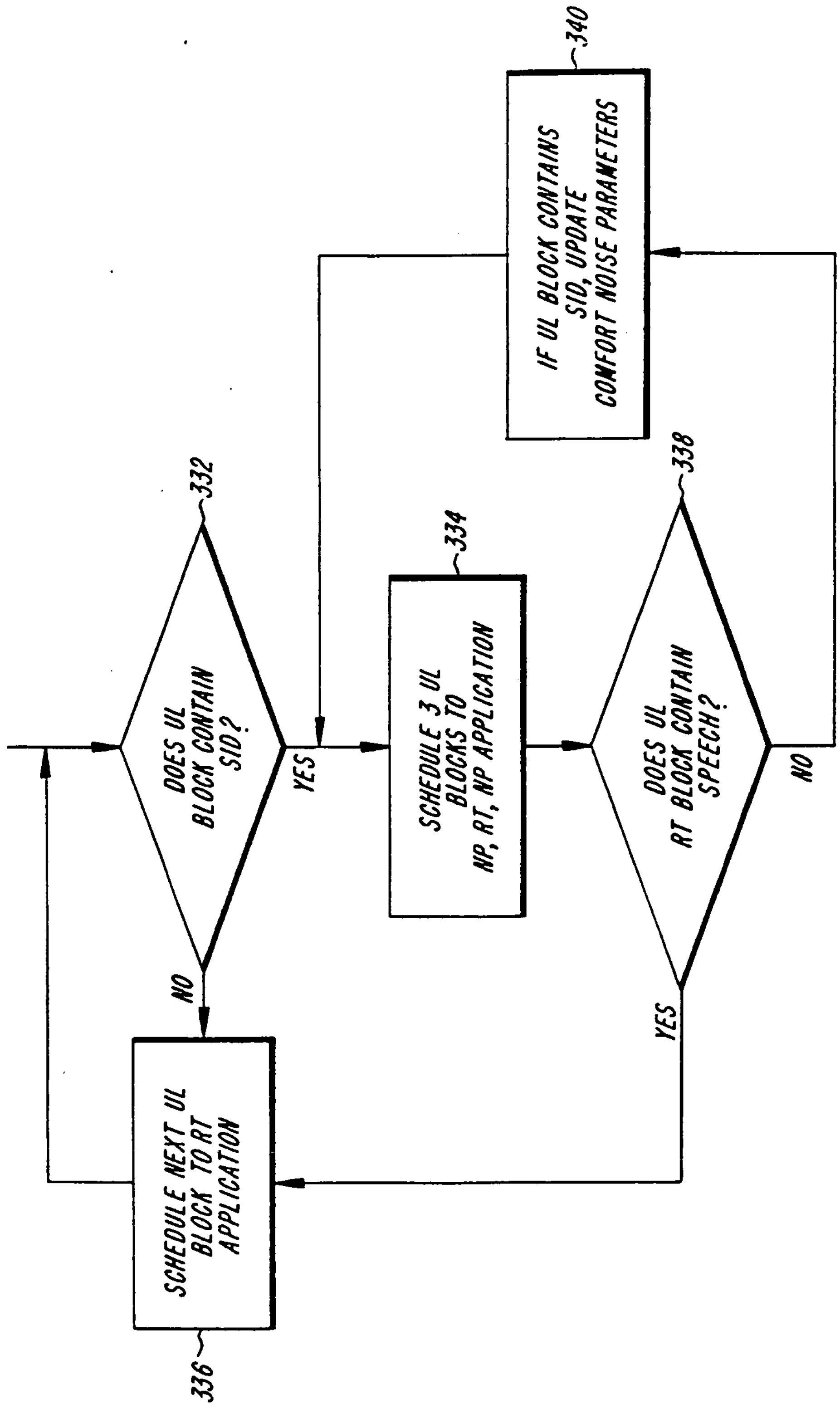

DOES UL BLOCK CONTAIN SID?
332
YES
NO
SCHEDULE 3 UL BLOCKS TO NP, RT, NP APPLICATION
334
DOES UL RT BLOCK CONTAIN SPEECH?
338
YES
NO
IF UL BLOCK CONTAINS SID, UPDATE COMFORT NOISE PARAMETERS
340
SCHEDULE NEXT UL BLOCK TO RT APPLICATION
336

FIG. 3B

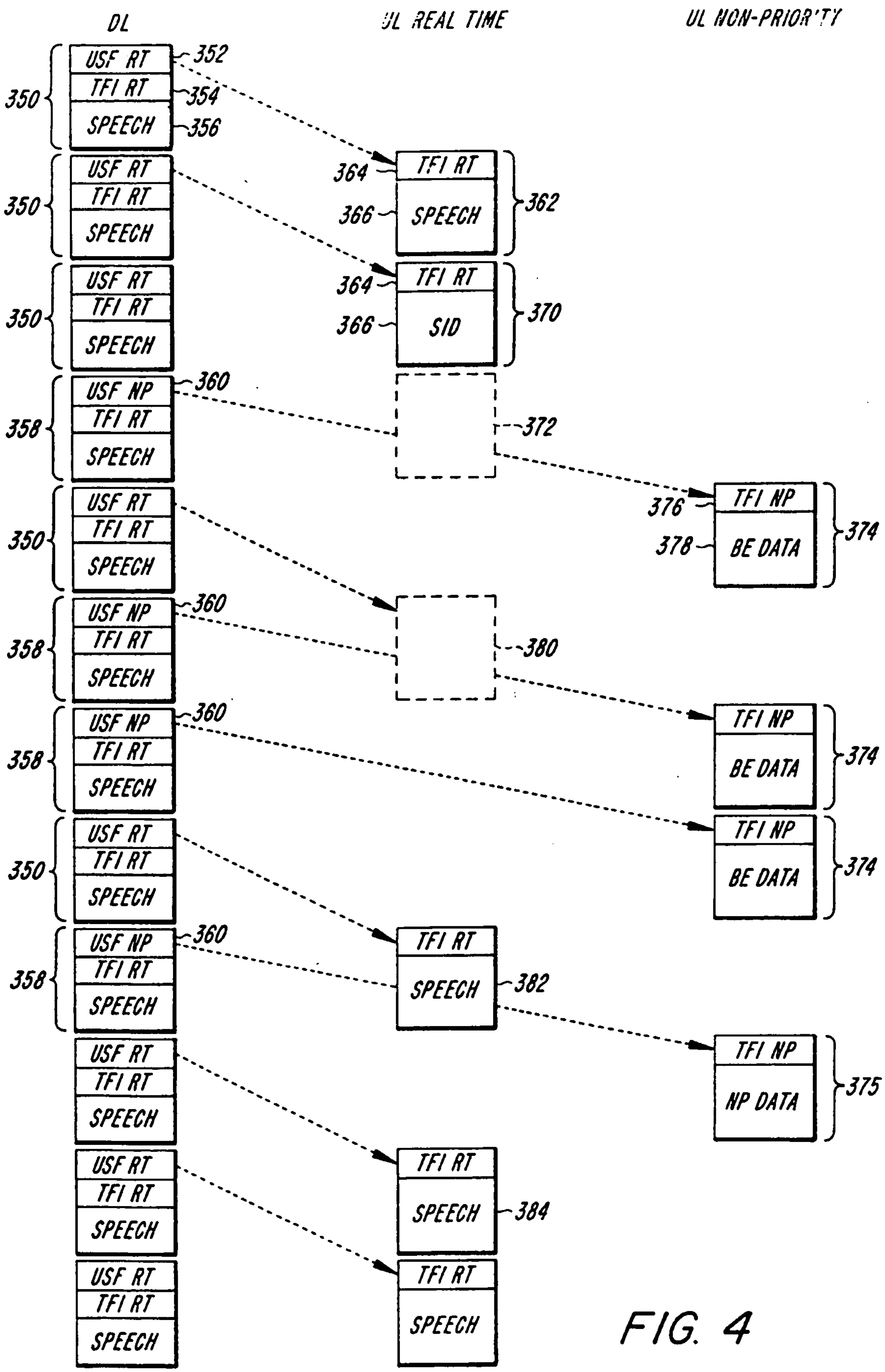

DL
UL REAL TIME
UL NON-PRIORITY
USF RT
TFI RT
SPEECH
USF NP
TFI NP
BE DATA
NP DATA
SID
350
352
354
356
358
360
362
364
366
370
372
374
375
376
378
380
382
384

FIG. 4

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
1 February 2001 (01.02.2001)

PCT

(10) International Publication Number
WO 01/08426 A3

(51) International Patent Classification⁷: H04Q 7/38, H04L 12/56

(21) International Application Number: PCT/SE00/01399

(22) International Filing Date: 30 June 2000 (30.06.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/145,221 23 July 1999 (23.07.1999) US
09/468,643 22 December 1999 (22.12.1999) US

(71) Applicant: TELEFONAKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; SE-126 25 Stockholm (SE).

(72) Inventors: YARED, Marlene; 53 Roosevelt, Dollard des Ormeauway, Québec H9G 1J1 (CA). MAZUR, Sara; Vikavägen 11, S-167 71 Bromma (SE). MOLNÖ, Johan; Kungsklippan 12, S-112 75 Stockholm (SE).

(74) Agent: MAGNUSSON, Monica; Ericsson Radio Systems AB, Patent Unit Radio Access, S-164 80 Stockholm (SE).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

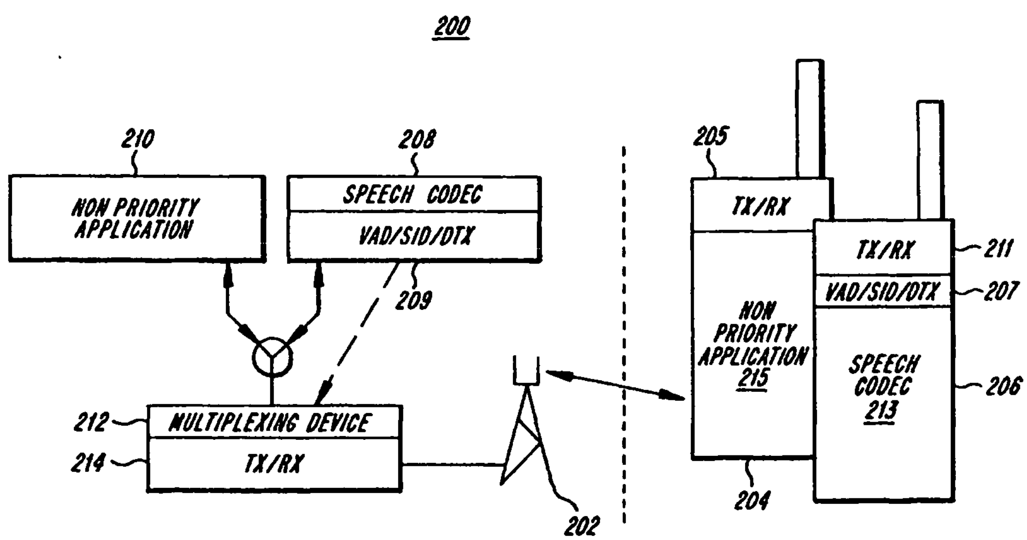
(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

(88) Date of publication of the international search report: 9 August 2001

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: MULTIPLEXING OF REAL TIME USERS AND NON-PRIORITY USERS ON AN EGPRS CHANNEL



(57) Abstract: Real time services (e.g., speech communication) are multiplexed with non-priority services (e.g., short message service and/or electronic mail service) once a silent period is detected in a real time communication. The non-priority services are aborted once the real time communication has become active again after the silent period.

WO 01/08426 A3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01399

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/38, H04L 12/56

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9857509 A2 (NOKIA TELECOMMUNICATIONS OY), 17 December 1998 (17.12.98), page 9, line 18 - page 10, line 34; page 13, line 30 - page 15, line 15; page 15, line 18 - page 16, line 6, figure 6, abstract --	1-32
X	WO 9609708 A2 (NOKIA MOBILE PHONES LTD.), 28 March 1996 (28.03.96), page 4, line 23 - page 7, line 29; page 7, line 32 - page 9, line 2 --	1-32
A	WO 9102436 A1 (TELECOM SECURICOR CELLULAR RADIO LIMITED), 21 February 1991 (21.02.91), page 4, line 11 - line 25 --	1-32

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 November 2000	05. 02. 2001
Name and mailing address of the International Searching Authority European Patent Office P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel(+31-70)340-2040, Tx 31 651 epo nl, Fax(+31-70)340-3016	Authorized officer Nabil Ayoub/JAn Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 00/01399

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9521492 A2 (MOTOROLA INC.), 10 August 1995 (10.08.95), see whole document	1-32

--

SA 4529

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/11/00

International application No.
PCT/SE 00/01399

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9857509 A2	17/12/98	AU 7768498 A	30/12/98
		CN 1260103 T	12/07/00
		EP 0983700 A	08/03/00
		FI 105306 B	00/00/00
		FI 972461 A	11/12/98
		ZA 9804927 A	04/01/99
WO 9609708 A2	28/03/96	AU 3389695 A	09/04/96
		FI 103700 B	00/00/00
		FI 944352 A	21/03/96
WO 9102436 A1	21/02/91	AT 157834 T	15/09/97
		AU 639476 B	29/07/93
		AU 6179590 A	11/03/91
		DE 69031391 D,T	29/01/98
		DK 485494 T	02/03/98
		EP 0485494 A,B	20/05/92
		ES 2110416 T	16/02/98
		FI 104030 B	00/00/00
		FI 920409 D	00/00/00
		GB 8917452 D	00/00/00
		HK 1002844 A	00/00/00
		JP 2999549 B	17/01/00
		JP 5501484 T	18/03/93
		US 5507006 A	09/04/96
WO 9521492 A2	10/08/95	CA 2156636 A	10/08/95
		FI 954571 A	27/09/95
		JP 8508870 T	17/09/96
		SE 9503360 A	30/11/95
		US 5533019 A	02/07/96